THE CANADIAN ARMY MEDICAL SERVICE.

BY

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THE adage, "Cast thy bread upon the waters, and thou shalt find it after many days," had never truer exemplification than in the relations found existing in this great war of all the ages between the R.A.M.C. and the Canadian A.M.C. The latter is the lusty progeny of the former, and well pleased that the physique and lineaments of the parent can be seen in the child. In all matters of present-day organization, equipment, and even uniform, the two services are closely homologated and interchangeable. But in spirit, and sympathy, and attainments, and just and generous emulation their relations are more fraternal than parental.

During the somewhat troubled years which followed in British North America after the rebellion of the American colonies the British troops who helped, as in the war of 1812–1815, to safeguard the feeble settlements of Nova Scotia, Lower Canada, and Upper Canada, had their medical officers—army doctors as they were known. Not a few of these well-trained men left the service to settle down to practice in Canada, and in most cases at once secured a commanding professional position in the new community. Their superior education and good social position gave to many of them great influence with the authorities, especially in Upper Canada—now Ontario—and this influence was always exerted in favour of sound legislation on all matters pertaining to education, both general and professional. The provinces were thus from the outset, to a very large extent, protected from the evils of free and unlicensed medical practice, from which the United States are only now with much effort and delay beginning to shake themselves free. British ideals in both teaching and practice have in the main prevailed everywhere in Canada, the precedent and example of the medical legislation in the older provinces being closely followed in the newer as they were organized, so that all the medical faculties in Canada have always drawn their inspiration, neither from American nor German sources, but from the great schools of London, Edinburgh, and Dublin.

With this heritage, nothing could be more natural and legitimate than that the Canadian Army Medical Service should both give and get, in this time of sore trial for all British hopes and ideals, absolute mutual co-operation and goodwill in its relations with the Royal Army Medical Corps and Service. The opportunity of comradeship and common service in the stricken field and in the cause of empire and civilization is keenly realized and most highly prized by all ranks.

The intimacy between the two services is evidenced by the circumstance that many scores of Canadian graduates hold temporary commissions in the R.A.M.C., and the value of their services is freely acknowledged by their fellow officers. Furthermore, the Canadian laboratory man has been given his chance and has made good in both British and Canadian laboratories in the field, and the friendly rivalry and hearty good comradeship of their work has gone far to make permanent for all time the good relations which are and can be based only upon mutual respect. One dreams of the day when the degree or licence of any reputable faculty in the empire may run and be recognized as valid in all the parts of the empire.

A summary of the activities of the C.A.M.C. may be made under the three topics:

1. Preventive medicine;
2. Clinical progress in medicine and surgery; and
3. Laboratory and research work.

PREVENTIVE MEDICINE.

With reference to preventive medicine the two outstanding features of the situation are:

(*a*) Preventive inoculation.
(*b*) Sanitary control in the field.

(*a*) *Preventive Inoculation.*

On the Western front, where most of the Canadian medical troops have been employed, this has been mainly against the typhoid group, small-pox, and tetanus.

The percentage of inoculated men as regards the first two runs very high, practically 100 per cent., as the conscientious objector is not recognized by the Canadian authorities and legitimate means have been found for overcoming the objections of the very few who were at first disinclined to submit.

Antitetanic serum has been administered in all main dressing stations to all wounded, and latterly to trench foot cases, at the time of their admission, the dose being entered on field medical card and in the admission and discharge book. The dose has been, as a rule, 1,500 units. The serum has been to a large extent, but not exclusively, obtained from the Canadian Red Cross Society, and is that manufactured in the laboratories of the University of Toronto through the thoughtful provision of a wealthy benefactor there. The regular source of supply through the advanced dépôts of medical stores has also been drawn upon. Comparisons and results are not available as yet, but there is no doubt in the minds of all in a position to judge that, as a preventive measure, the procedure is proved to be indispensable.

The same remark holds true, if possible more positively, with regard to antityphoid inoculation. When regard is had to the practical absence of true typhoid and to the extraordinarily low incidence of the other diseases of the enteric group on the one hand, and to the universal contamination of the water supply by the colon group on the other, one may truly say that a new chapter may now be written in the history of military medicine, and that the world at large owes to Sir William Leishman and the R.A.M.C. a debt which it can never repay; and it should not be forgotten that the millions of men now in the war zone and far from their accustomed strains of enteric infection represent, without inoculation, virgin soil for the ravages of the disease.

Small-pox has been practically non-existent among the Canadian troops, as each man signs in his attestation papers an undertaking to undergo vaccination, which is universal.

Dysentery has occurred in a slight, sporadic form, but not as either epidemic or endemic. Such cases, even though only suspected, are sent to a special hospital in each army direct from the field ambulance, admitting by motor ambulance convoy car.

(*b*) *Sanitary Control in the Field.*

The two important parts of this many-sided problem are water control and disposal of waste. The organization necessary is briefly as follows:

1. Battalion and unit sanitary sections, specially detailed and trained by unit medical officers and employed under their direction. Responsibility rests with each O.C. for his own lines, the M.O. acting as adviser.

2. Divisional sanitary section under a specially qualified medical officer, who is also divisional sanitary officer, under command of A.D.M.S. of Division, reporting to him, and employing the other ranks of his unit as inspectors over the whole area occupied by the Division with reference to water supply, disposal of waste, and conservancy arrangements of every sort.

The opinion has been steadily growing that for the semi-siege type of warfare so far prevailing on the Western front, too frequent moves of these divisional sanitary sections detract seriously from their usefulness, and that they should, within limits, be made more permanently responsible for the areas with which they have become familiar, after the manner in which town majors and camp commandants are employed.

With respect to the protection of the water supply, in addition to the supervision maintained by the divisional sanitary sections, which is good, the Canadian corps has in action a water patrol. This patrol places a second check upon the chlorination of water.

Experience has shown that a water which gives a good reaction for the presence of free chlorine half an hour after the addition of chloride of lime can be considered a safe water. The requisite amount—1 gram (1 scoop), or more, to 110 gallons (the capacity of the water-cart)—is gauged by testing at frequent intervals during the day, the amount varying according to the organic content of the water. Small cases are supplied to the British Expeditionary Force, whereby sanitary or regimental medical officers may so test water and establish the amount of chloride of lime necessary to produce sterilization. Mobile laboratories are

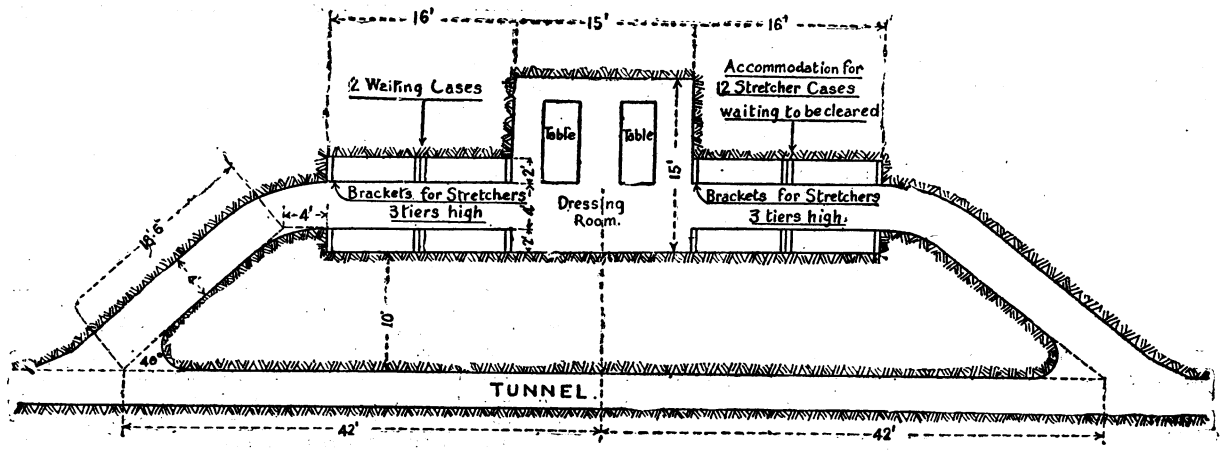

FIG. 1.—Regimental Aid Posts in a Tunnel. Accommodation, 24 cases.

available to examine and give any information on request. Muddy water must first be filtered, otherwise sterilization will not be complete, the chloride of lime failing to penetrate to the centre of particles of mud.

Water patrols, covering a Canadian corps area, are in charge of an officer under the "Q" Branch. A survey is made, maps prepared, and information collected. The corps area is then subdivided into patrol sections, each section being patrolled by one N.C.O. and five men (permanent base). The duties of these patrols are as follows:

(*a*) To see that rivers, streams, ponds, wells, and springs are not polluted.

(*b*) To see that no washing and no watering of horses are done at any but authorized points.

(*c*) To see that no material connected with the corps water system is destroyed or removed without corps or divisional orders.

(*d*) To visit daily each of the water tanks, stand-pipes, etc., where water carts are filled, collecting the daily report from the "divisional control" in charge.

Divisions are responsible that all orders regarding chlorination and "water details" are carried out, and also all instructions, such as those mentioned in paragraph (*b*). Any unit not complying with instructions regarding water supply is reported by the water patrols to the water patrol officer, but this does not relieve divisions from their responsibility for seeing that all instructions are carried out. Where a unit is reported to the water patrol officer a report is forwarded to the division concerned. Should the same unit be reported a second time, a report is forwarded to corps head quarters. Men belonging to, or attached to, the divisional sanitary sections are detailed as "water controls" by the O.C. sanitary sections for all authorized supplies in the divisional area. These water controls keep a "daily tank report" in triplicate, which sets forth the condition of carts drawing water, condition of lime, etc. A copy of these reports is forwarded daily to the divisional sanitary officer, one copy to water patrol officer, and one copy is retained as record by the water control. The divisional sanitary officer is responsible that the necessary steps are taken to prevent a recurrence. The O.C. water patrols summarizes these daily tank reports once a week; a copy of this is sent to the D.D.M.S. A record is thus kept.

Other matters pertaining to the water supply are also reported to the D.D.M.S., and thus the medical services work in conjunction with the other branches to maintain as adequate and good a supply of drinking water as possible.

The incidence of water-borne diseases in the Canadian corps has been low, and it may be said has only occasioned anxiety when conditions were such as to interfere with, or prevent, the maintenance of those measures which have been indicated above.

Reference should be made to the very important topic of baths and laundries. In most British divisions it is understood that these establishments are under the control and administration of the A.D.M.S. for the "A and Q" branch of the staff. In the Canadian divisions the practice has been to relieve the medical service of this responsibility and to place in charge a capable business man who is an officer seconded from his unit to the staff of the division. This has given excellent results, and would seem to be less wasteful of the special training of the medical officers, though close co-operation always exists between the A.D.M.S. and the officer in charge of baths and laundries through the A.A. and Q.M.G. The Foden-Thresh lorry disinfector, for instance, which is on charge to the sanitary section and under the control of the A.D.M.S., is kept in operation at the divisional baths, where the men exchange their soiled clothing for fresh. Ordnance by arrangement makes issue of socks and underwear through the baths officer.

CLINICAL PROGRESS IN MEDICINE AND SURGERY.

The barest reference alone is possible to so wide a subject; a few topics of interest have been selected.

1. *Injuries and Diseases of the Lung.*

In a general way we have come to a set method of treating wounds of the lung, which usually reach the base hospital not earlier than the fifth day after infliction. Gunshot wounds rarely, shell wounds frequently, are complicated. Haemothorax is usually demonstrable, and the history of haemoptysis is generally present. The rapidity with which blood is spat up after wounding depends on whether the upper or lower part of the lung is wounded, the haemorrhage being most prompt in the case of the former. Fever is usually present in the earlier days, often disappearing by the sixth or seventh day. When the fever continues we draw off blood from the pleura for the purpose of culture; such cultures usually prove sterile. As a usual thing we draw off by aspiration the blood about the tenth day; sometimes the blood so drawn off is replaced in a few days by effusion, so that subsequent aspirations may need to be made. The blood so drawn off is sometimes replaced by oxygen, the outflow of blood and the inflow of oxygen being made through separate needles at the same time. Of late we have not felt so keenly the necessity for the use of oxygen; our idea was that the replacement allowed a less chance of disturbance of the bulk of the lung, with consequent haemorrhage. An uncomplicated case is fit to travel, we judge, about the thirteenth or fourteenth day. The possibility of seasickness and vomiting is the chief reason against allowing cases to travel at an earlier date, as the repair of the lung wound seems to be relatively slow.

With shell wounds of the lung, and in cases where the foreign body remains in the chest cavity, no set method of treatment is possible. The *x* rays and the fluoroscopic screen are used to the fullest extent in all these cases; a certain small percentage of patients with foreign body are found amenable to early operation with removal. The relative infrequency of infection of the pleural blood is remarkable. I have personally seen only two cases of gas infection of the pleural blood, both of which recovered. A number of other infections by large bacilli, which might have been gas bacilli, but were not certainly so, have been treated as empyema and drained, and, so far as we know, with recovery in all cases.

In a winter such as 1916–17, there was a great prevalence of infection of the respiratory tract, including

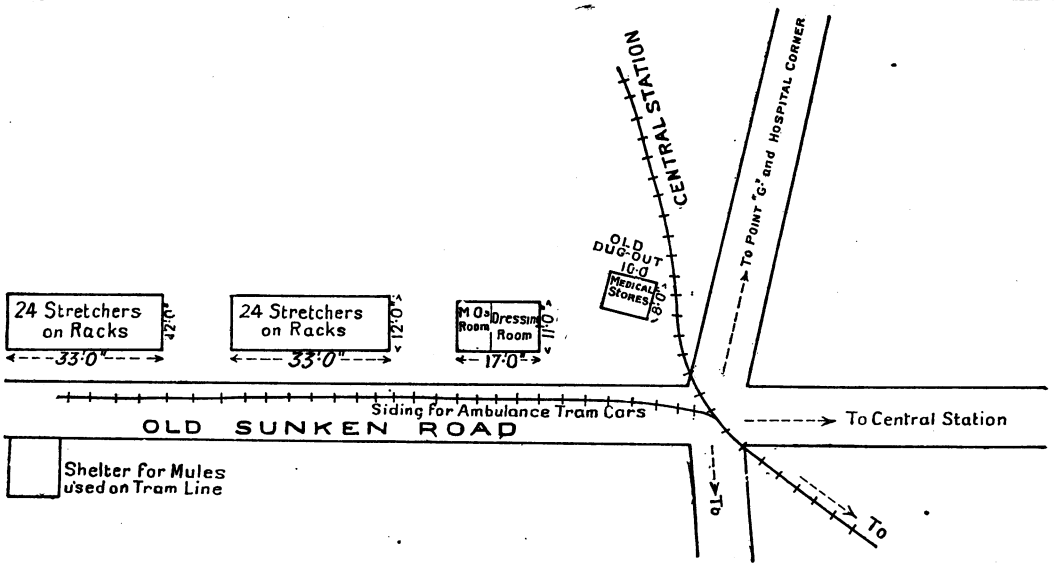

FIG. 2.—Advanced Dressing Station. Accommodation, 40 cases. This dressing station is situated in an old sunken road, and is fragment-proof. A siding has been placed in front of the station for hospital tram-cars, and a shelter has been built in the cut bank for the mules used in hauling tram-cars.

pneumonia, but it is remarkable how little prevalent lobar pneumonia has been. Severe cases of bronchitis, tracheitis, and laryngitis are common, and loss of the speaking voice is very often seen. It is difficult to distinguish mild bronchopneumonia from severe cases of bronchitis, and the presence of pneumococcus is in no sense diagnostic, as most cases show it to be present. The diagnosis has to be made on clinical grounds, and most frequently a high degree of physical disturbance, continued high fever, and the presence of blood streaks, blood or rose colour in the sputum, is used to determine the diagnosis in favour of bronchopneumonia.

A tendency to extension of the disease from one part of the lung to another at different times in the course of the malady is remarkable, so that sometimes patients are ill for weeks, with apparent extensions of the disease; the final chart of such a patient looks like a typhoid fever chart; so true is this, that in many cases we have been compelled to make agglutination tests for typhoid and paratyphoid fever, with almost constantly negative results. The absence of sunny, clear weather in winter in the northern parts of France seems to be responsible for the slow convalescence of many patients suffering from disease of the respiratory tract.

2. *Continued Fevers (or "P.U.O." Cases).*

Considering the cases of continued fever (or "pyrexia of unknown origin") coming to the hospital, it becomes necessary to divide them into the constituent diseases—namely, typhoid and paratyphoid fevers, so-called trench fever, and other less specific infections. Since the whole army is inoculated, the clinician is no longer able to determine on clinical grounds whether a case of continued fever be typhoid, paratyphoid, or another. The classical signs of enlarged palpable spleen, rose spots, etc., are too often absent. A dirty tongue implies gastro-intestinal disturbances but is in no wise specific. The old-fashioned Widal test is useless because it is positive by reason of inoculation. It therefore becomes necessary to make a quantitative agglutination test, which is done in series; this is done at intervals of not less than four days, and the positive diagnosis of typhoid or paratyphoid "A" or "B" may be possible by observing that there is an agglutination curve and not a stable agglutination line. From this it will be inferred that a diagnosis is sometimes made by a quantitative fall in agglutination power as well as by a rise, the fall or rise depending upon the phase in agglutination power which the blood shows at the time it is taken. No longer is the typical typhoid temperature chart to be seen. Regular, more or less continued fever, or even an acutely relapsing fever is to be seen; patients belonging to this group show very frequently myalgic pains, pains in the neck, pains in the thighs, pains in the shin bones, so that a diagnosis of the so-called trench fever upon clinical grounds becomes as difficult as a diagnosis of typhoid and paratyphoid fever. All the cases admitted into one base hospital during a certain period last winter with the provisional diagnosis of pyrexia of unknown origin—that is to say, cases which were clinically transient pyrexias with no symptoms beyond the elevation of temperature and malaise—were examined bacteriologically, and it was demonstrated that 68 per cent. were typhoid or paratyphoid. Blood cultures and examinations of the stools for typhoid and paratyphoid fever were singularly useless. During the winter 150 cases suspected of typhoid or paratyphoid, whose stools were examined three times in succession, gave no positive result on any occasion.

3. *Methods of Localizing Foreign Bodies.*

A large percentage of the work done in an operating room of a base hospital in war time consists in the removal of foreign bodies. It is essential that this should be done with the least possible amount of traumatism, and this means that the position of the foreign body should be definitely known before the operator begins to work. The localization of these foreign bodies becomes therefore almost an art in itself, and the development of that art—if one may so call it—in the course of this war would be perfectly amazing to a civil surgeon. It is proposed, therefore, to give as briefly as possible, an account of the different methods used to locate accurately any foreign body.

For foreign bodies of known dimensions—for example, rifle bullets and shrapnel balls—a Canadian radiographer, Captain A. Howard Pirie, has devised a very ingenious scale, based upon the fact that the shadow of the foreign body increases in size as the plate is removed farther from the body. Suppose, then, the plate to be in contact with the skin, all that one has to do is to measure the size of the skiagram of the foreign body, and compare it with the scale, which will at once indicate the depth from the skin surface of the foreign body. A reference to the cross section atlas will then at once give one the position of the foreign body.

The Mackenzie Davidson method, by triangulation, of localizing the depth of a foreign body from a mark, placed previously upon the skin, is in constant use for all foreign bodies, such as pieces of shell, which are of unknown size.

If there is reason to believe, after measuring the depth of the foreign body and comparing it with the atlas, that the foreign body is in the thorax or the abdomen, a stereoscopic view is then taken and the location of the body is easily determined by looking into the adjustable stereoscopic apparatus.

As aids in the operating-room, we place first the large electro-magnet bearing the name of Bergonié of Paris. By its use can be determined the exact position of all electromagnetic substances, and, fortunately, German bullets are electro-magnetic, whilst the English and French bullets are not. Even when these bodies are deeply situated, and their vibration cannot readily be made out by the hand, it can easily be heard by the stethoscope, placed on the skin opposite the electro-magnet. A sound, very like a steamboat whistle, indicates the nearest point to the foreign

body, and the skin is marked at that point. In the case of non-magnetic foreign bodies, such as lead, brass, and nickel, or in the case where a magnetic foreign body is embedded in bone, and therefore cannot vibrate, we have recourse to the use of the telephone probe or, rather, forceps. This is of great assistance in locating the foreign body, either in the soft tissues or in the bone, and enables us to extract it with a minimum of damage to the tissues. In other cases, again, when the foreign body will not vibrate, or has possibly changed its position in the soft parts since the *x*-ray picture was taken (and this is notably so with foreign bodies in joints), we operate under the fluoroscopic screen.

It should be borne in mind that practically all the stationary and general hospitals sent by Canada have come from the medical faculties of the universities. A list of these it would not at the present juncture be wise perhaps to publish, but the fact that each one includes in its personnel the selected specialists and teachers in all branches of medicine and surgery from every medical faculty in the country, ensured from the outset a very high standard of professional efficiency. In addition, effective military administration has in most cases been secured, as in most of the universities there were medical men of military experience, both in the militia and in the South African war, and in the Canadian permanent service.

It is no improper divulging of official secrets to say that, both in the Mediterranean area and in France, the highest army medical authorities state that they have found these Canadian units second to none in the whole service. Their facilities for good service, too, are enhanced by the possession in several instances of large funds subscribed by the friends of their universities at home for additions to their equipment and supplies.

Laboratory and Research Work.

The third main topic suggested at the outset of this article was laboratory and research work. Again, figures and statistics may not be given, and in any case could be as yet only partial. But valuable work has been done by Canadian workers, both in Canadian mobile laboratories and in collaboration in British units, in Britain, in France, and in the Mediterranean.

An enormous volume of work has been done also as part of the daily routine of the general and stationary hospitals, which requires time for the making of generalizations. Special researches of which one has heard have been made upon continued fevers, pyrexias of unknown origin, nephritis, trench fever, stomatitis, meningitis, and epidemic jaundice.

Dental Services.

No account of the work of the C.A.M.C. would be adequate which failed to recognize the good work of the dental officers.

The dental profession in Canada is entirely distinct from the medical in respect of both training and control. There are separate Acts of Parliament for each of the professions in all the provinces. It may be that these circumstances underlay the decision of the late Minister of Militia to establish a separate Canadian Army Dental Corps. Members of the dental corps are posted one to each field ambulance in the field, and to each casualty clearing station and stationary and general hospital. In addition, there is a corps dental laboratory, where artificial dentures are made and repaired with very little loss of time or delay, such as was the case when there was no laboratory nearer than the base in France. The loss of military time from dental causes has been reduced to a minimum.

Apart from the value of their professional services to the troops at the front, which cannot be overstated, the dental officers with field ambulances take their full share of military duty in their units, on the same footing as the medical officers, and have thus still further proved their indispensability.

In France the dental service has been placed completely under the medical service, as it was realized that only one channel would be permitted for which a man might, for reasons connected with health, be allowed to escape duty. The arrangement has been completely effective and satisfactory to both dental and medical officers.

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ON THE ETIOLOGY OF TRENCH FEVER.

(A Preliminary Communication.)

BY

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THE following observations bearing upon the etiology of trench fever are presented at this time because of the importance of this disease from a military viewpoint, and the desirability of having other workers confirm or refute our findings while material for the study of the disease is available in abundance.

Since our work is incomplete in many particulars, we shall at this time present merely a brief note of our experience, reserving a full publication for a later date. The literature has been available to us only in abstract form, but having no information that similar organisms have been described in connexion with the disease, we shall withhold a discussion of the work of others in this field for a later publication.

I. *The Occurrence of an Organism in the Blood of Trench Fever Cases.*

On June 26th, 1917, while examining a blood smear from Pte. B., a typical case of trench fever, there were found great numbers of small, circular or slightly oval, bluish-purple bodies lying upon the blood cells, or free in the plasma. They were distinctly outlined, often somewhat paler in the centre, and with a minute, intensely stained granule of pigment or chromatin at the periphery. The size of these bodies varied somewhat, averaging about one-fifth or one-sixth the diameter of a red blood cell, or approximately 1 to 1.5 microns. Not infrequently two or even several of them were found lying upon a single red corpuscle. They were not present within the leucocytes.

Since this first observation, a systematic study of blood smears of cases of trench fever admitted to the hospital has been made. Bodies of identical appearance have been found in nine cases, over 150 patients having been examined, some of them repeatedly. In some of these a few fairly typical forms have been found after long search, but in the nine cases referred to the bodies were extremely numerous, and assumed the form described. Their appearance in numbers in the circulating blood appears to be exceptional and transitory. For example, in one case (R.) a smear obtained at 3.30 p.m. showed innumerable typical forms; in smears taken at 9 p.m. none was found after prolonged search. Our records are not sufficiently complete to determine whether the appearance of the bodies in the blood coincides with febrile paroxysms and the exacerbation of the clinical symptoms. It is our impression that such is the case, although we have repeatedly failed to find the bodies during a pyrexial attack.

For the staining of the bodies Wright's, Giemsa's, and Leishman's stains have all been found satisfactory. After fixation of the films in bichloride-alcohol or Zenker's fluid the bodies stain more intensely than after fixation in methyl alcohol. Care has been taken to eliminate the possibility that the bodies observed might be artefacts. The stains have been diluted with freshly distilled water, and many controls prepared with the identical stains have been studied. The films in some of the positive cases were made on cover-glasses which had been boiled in nitric acid, so that the possibility that we are dealing with contaminating bodies on the glass seems remote.